VXI

VXI-1501
User Manual

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Worldwide Technical Support and Product Information

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FCC/Canada Radio Frequency Interference Compliance*

Determining FCC Class

The Federal Communications Commission (FCC) has rules to protect wireless communications from interference. The FCC places digital electronics into two classes. These classes are known as Class A (for use in industrial-commercial locations only) or Class B (for use in residential or commercial locations). Depending on where it is operated, this product could be subject to restrictions in the FCC rules. (In Canada, the Department of Communications (DOC), of Industry Canada, regulates wireless interference in much the same way.)

Digital electronics emit weak signals during normal operation that can affect radio, television, or other wireless products. By examining the product you purchased, you can determine the FCC Class and therefore which of the two FCC/DOC Warnings apply in the following sections. (Some products may not be labeled at all for FCC; if so, the reader should then assume these are Class A devices.)

FCC Class A products only display a simple warning statement of one paragraph in length regarding interference and undesired operation. Most of our products are FCC Class A. The FCC rules have restrictions regarding the locations where FCC Class A products can be operated.

FCC Class B products display either a FCC ID code, starting with the letters **EXN**, or the FCC Class B compliance mark that appears as shown here on the right.

Consult the FCC web site `http://www.fcc.gov` for more information.

FCC/DOC Warnings

This equipment generates and uses radio frequency energy and, if not installed and used in strict accordance with the instructions in this manual and the CE Mark Declaration of Conformity**, may cause interference to radio and television reception. Classification requirements are the same for the Federal Communications Commission (FCC) and the Canadian Department of Communications (DOC).

Changes or modifications not expressly approved by National Instruments could void the user's authority to operate the equipment under the FCC Rules.

Class A

Federal Communications Commission

This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at his own expense.

Canadian Department of Communications

This Class A digital apparatus meets all requirements of the Canadian Interference-Causing Equipment Regulations.

Cet appareil numérique de la classe A respecte toutes les exigences du Règlement sur le matériel brouilleur du Canada.

Class B

Federal Communications Commission

This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

- Reorient or relocate the receiving antenna.
- Increase the separation between the equipment and receiver.

- Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.
- Consult the dealer or an experienced radio/TV technician for help.

Canadian Department of Communications

This Class B digital apparatus meets all requirements of the Canadian Interference-Causing Equipment Regulations.

Cet appareil numérique de la classe B respecte toutes les exigences du Règlement sur le matériel brouilleur du Canada.

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Readers in the EU/EEC/EEA must refer to the Manufacturer's Declaration of Conformity (DoC) for information** pertaining to the CE Mark compliance scheme. The Manufacturer includes a DoC for most every hardware product except for those bought for OEMs, if also available from an original manufacturer that also markets in the EU, or where compliance is not required as for electrically benign apparatus or cables.

* Certain exemptions may apply in the USA, see FCC Rules §15.103 **Exempted devices**, and §15.105(c). Also available in sections of CFR 47.

** The CE Mark Declaration of Conformity will contain important supplementary information and instructions for the user or installer.

Conventions

The following conventions are used in this manual:

This icon denotes a note, which alerts you to important information.

This icon denotes a caution, which advises you of precautions to take to avoid injury, data loss, or a system crash.

This icon denotes a warning, which advises you of precautions to take to avoid being electrically shocked.

italic

Italic text denotes variables, emphasis, a cross reference, or an introduction to a key concept. This font also denotes text that is a placeholder for a word or value that you must supply.

`monospace`

Text in this font denotes text or characters that you should enter from the keyboard, sections of code, programming examples, and syntax examples. This font is also used for the proper names of disk drives, paths, directories, programs, subprograms, subroutines, device names, functions, operations, variables, filenames and extensions, and code excerpts.

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Using the Mainframe

Mainframe Description

The VXI-1501 mainframe is designed in full compliance with the VXIbus specification (Rev. 2.0). The mainframe contains 13 slots for plug-in modules and can be rack mounted in either the forward or reverse position. Other features of the VXI-1501 mainframe include the following:

- Power supply reliability
- Solid state automatic bus grant sensing to bypass empty slots (no backplane jumpers required)
- Variable speed fan cooling
- Rear mounted 25-pin D connector for auxiliary power supply monitoring
- Easy replacement of major components—most can be replaced from the rear of the mainframe, even while the mainframe is mounted in a rack
- Seven standard VXIbus power supply voltages—all overvoltage, overcurrent, and temperature protected
- Maximum usable power (total power supply output power before thermal protection shutdown): 1690 W @ 25 °C, 1690 W @ 40 °C, 1488 W @ 55 °C

Line Voltage and Input Power

The VXI-1501 mainframe includes a power supply that automatically adjusts for standard nominal line voltages of 100/120 VAC and 220/240 VAC, and nominal power line frequencies of 50 Hz and 60 Hz. The power supply has a power factor corrected input section and thus can be powered from any nominal line input within the range of 100 VAC to 240 VAC. The power supply can also be powered from a 400 Hz AC line frequency or DC power line voltages. Refer to Appendix A, *VXI-1501 Specifications*, for complete input power specifications.

Warning Refer to the *Safety Grounding Information* section in this chapter for complete grounding information when power line frequencies exceed 66 Hz.

Air Flow

The air flow into the plug-in module slots in the VXI-1501 mainframe is significant. The mainframe supplies each of the 13 slots with enough air to cool 60 W while maintaining only a 10 °C rise across a typically dense module. Up to 75 W per slot may be dissipated if a 15 °C rise is acceptable across a typically dense module. The graph of Figure 1-1 shows the air flow volume (liters/second) versus change in pressure across the module (mm H_2O) for the mainframe.

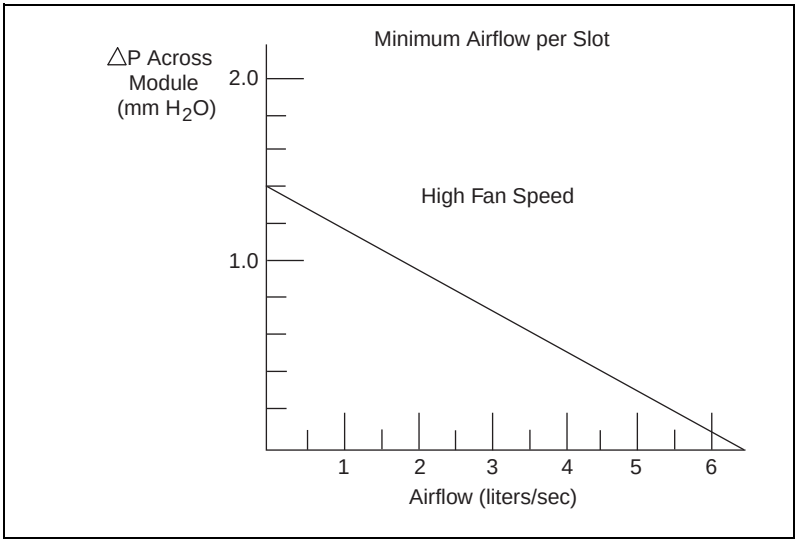


Figure 1-1. Minimum Airflow Available Per Slot

The mainframe has a fan chamber with three circulation fans. The speed of the fans is controlled by the ambient temperature of the air drawn into the mainframe. Air from the fan chamber is forced into the compartmentalized plenum at the bottom of the mainframe. Although the plenum does contain a compartmentalized structure, some air flow is always present in each of the 13 slots even if one of the three mainframe circulation fans fails to operate. The air passes through the installed modules and escapes out the sides and top of the mainframe.

If any plug-in module exceeds 40 W dissipation, you must provide a minimum of 20 mm (0.8 in.) of clearance above the mainframe.

A fourth fan provides cooling for the power supply. This fan is mounted on the side of the mainframe.

Caution When installing the mainframe in your system, ensure that the air inlets and outlets are not obstructed. This prevents damage to the mainframe and installed modules due to overheating. Clean the air filter regularly.

Variable Speed Fan

Normally, the speed of the four internal circulation fans is determined by the ambient temperature of the air drawn into the mainframe. One fan cools the power supply module and three fans cool the VXI modules inserted into the mainframe. You can override the temperature-controlled speed of the fans by changing the position of the Fan Speed Control Switch on the rear of the mainframe to High. This forces all four fans to remain at full speed all of the time. The two fan modes are:

- Variable Speed Mode (factory default): Quiet operation (~ 75% airflow) at <30 °C ambient temperature; high speed operation at >40 °C ambient temperature.
- High Speed Mode (switch selectable): Full airflow at all times.

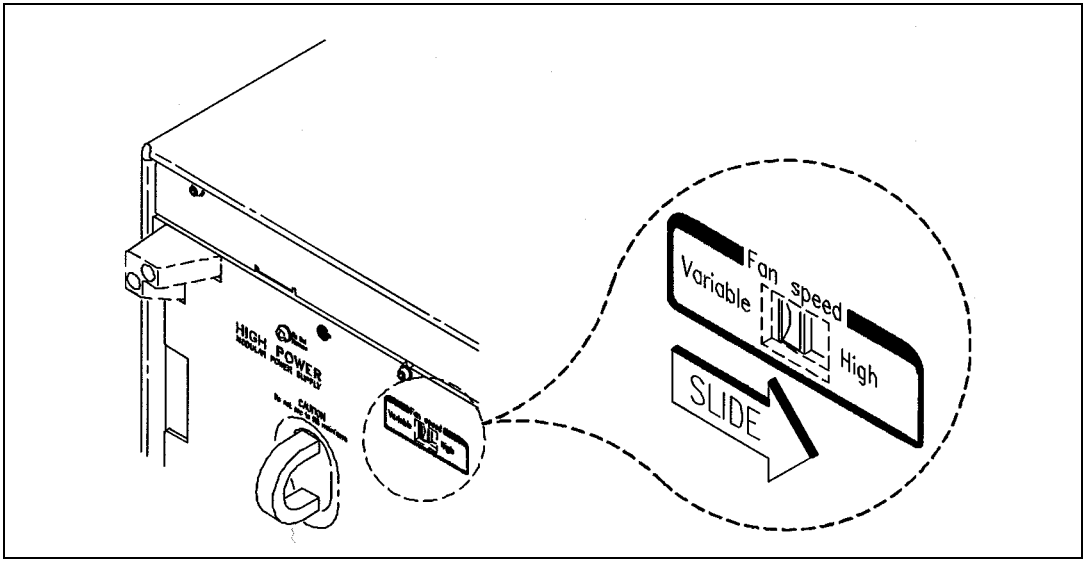


Figure 1-2. Forcing the Fan to High Speed

Rear Panel Auxiliary Connector

A 25-pin “D” connector is provided on the rear panel of the mainframe to allow monitoring of power supply voltages and other functions. The pinouts for this connector are shown in Table 1-1.

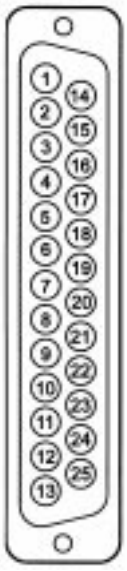


Table 1-1. Connector Pinouts and Description

Pin #	Function	Description
1	+5 VM	+5 V for voltage monitoring (2.4 mA max)
2	–12 VM	–12 V for voltage monitoring (2.4 mA max)
3	–24 VM	–24 V for voltage monitoring (2.4 mA max)
4	–2 VM	–2 V for voltage monitoring (2.4 mA max)
5	REM STDBY	Remote power switch
6	+5 V	+5 V output for charging batteries, running external TTL circuits, etc. 1 A max
7	+12 V	+12 V output for charging batteries, running external TTL circuits, relays, etc. 1 A max
8	+5 V STDBY	Input for +5 V standby current (for example, from external battery). Max 1 A combined total (pins 8 and 21).
9	GND	Chassis ground
10	SYSRESET*	Backplane SYSRESET* signal (input or output). If you use this pin, be careful not to violate backplane electrical specifications (that is, keep extender cable as short as possible).
11	EXHAUST_TEMP	An analog output signal proportional to the power supply exhaust temperature.
12	N/C	Not used
13	N/C	Not used
14	+12 VM	+12 V for voltage monitoring (2.4 mA max)
15	+24 VM	+24 V for voltage monitoring (2.4 mA max)
16	–5.2 VM	–5.2 V for voltage monitoring (2.4 mA max)
17	GND	Chassis ground
18	REM SW	Remote power switch return
19	GND	Chassis ground
20	GND	Chassis ground

Table 1-1. Connector Pinouts and Description (Continued)

Pin #	Function	Description
21	+5 V STDBY	Input for +5 V standby current (for example, from external batter). Max 1 A combined total (pins 8 and 21).
22	GND	Chassis ground
23	AC FAIL*	Backplane AC FAIL* signal (input or output). If you use this pin, be careful not to violate backplane electrical specifications (that is, keep extender cable as short as possible).
24	GND	Chassis ground
25	N/C	Not used

+5 V

The +5 V output lets you power external TTL circuitry if required. The maximum current allowed from this supply is 1.0 A.

+12 V

The +12 V output lets you power a battery charging circuit to provide a source for the +5 V STDBY input. The maximum current allowed from this supply is 1.0 A.

+5 V STDBY

This provides an input to the mainframe backplane for a +5 V standby power source. This may be from a separate battery or power supply. The maximum current input allowed is 1.0 A. This means that all standby circuitry in all modules mounted in the mainframe can draw a total of 1. 0 A when active.

SYSRESET*

This pin provides an extension of the backplane SYSRESET* signal. It can be used to monitor for SYSRESET* or to send SYSRESET* to the backplane. Shorting this line to ground inputs a SYSRESET* signal to the system. If you use any extension cable out of the 25-pin D connector on the mainframe rear panel, make certain that you do not violate VXI backplane electrical specifications (that is, keep the cable as short as possible or buffer the signal, etc.).

ACFAIL*	This pin lets you monitor the ACFAIL* signal from the backplane. Because this pin is connected directly to the backplane, do not violate VXI backplane electrical specifications (that is, keep the cable as short as possible or buffer the signal, etc.).
EXHAUST_TEMP	This pin provides an analog output that is proportional to the power supply exhaust temperature. Using this circuit, you can monitor the actual temperature of the power supply exhaust temperature to receive a warning signal that the mainframe is running under abnormal conditions. This output provides 0 VDC at 0 °C, with a rise of 10 mV per degree centigrade when referenced to chassis ground.

Remote Standby Switch

The remote standby switch connection lets you turn the mainframe ON or put it in STANDBY mode remotely. These two connections are wired in parallel with the front panel ON/STANDBY switch. The front panel switch must be in STANDBY position for the remote switch to function correctly.

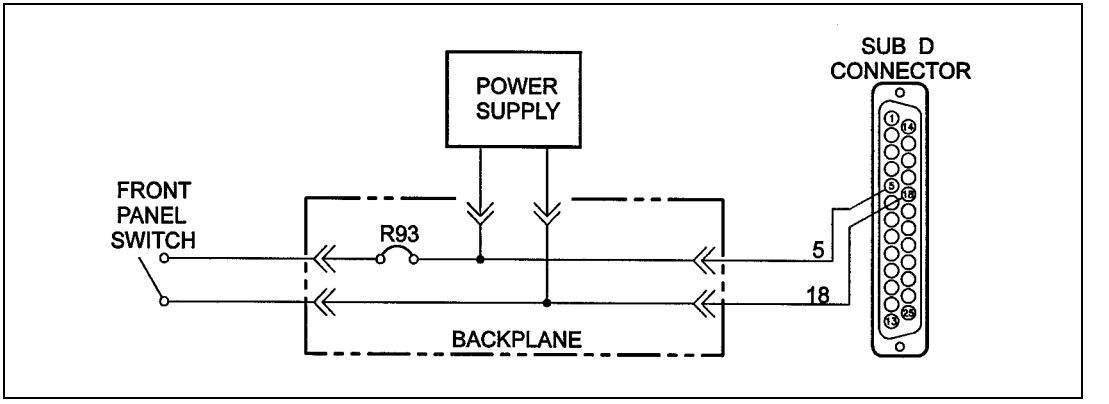


Figure 1-3. Remote Standby Switch Wiring

If you want to disable the front panel switch completely, you can remove R93 (a surface mount, 0 Ohm resistor) on the back of the backplane PCA. Figure 1-4 shows the location of this resistor. Once R93 is removed, the only way to control power is through a switch connected to pins 5 and 18 of the 25-pin D connector on the rear panel of the mainframe. To access the interface board, remove the power supply.

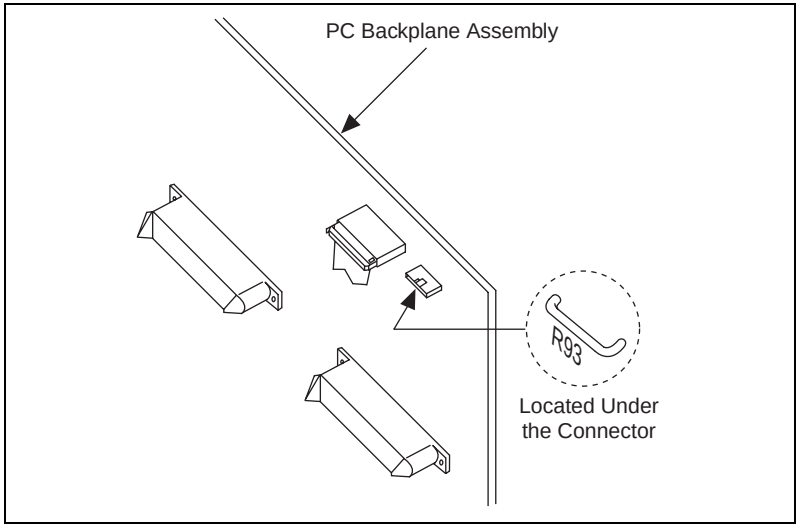


Figure 1-4. Location of R93 Surface Mount Resistor

Installing the Power Line Fuse

The mainframe is shipped with a 15 A fast blow (15 AF) fuse already installed. This fuse is suitable for all line voltages. Figure 1-5 shows how to replace the fuse if necessary.

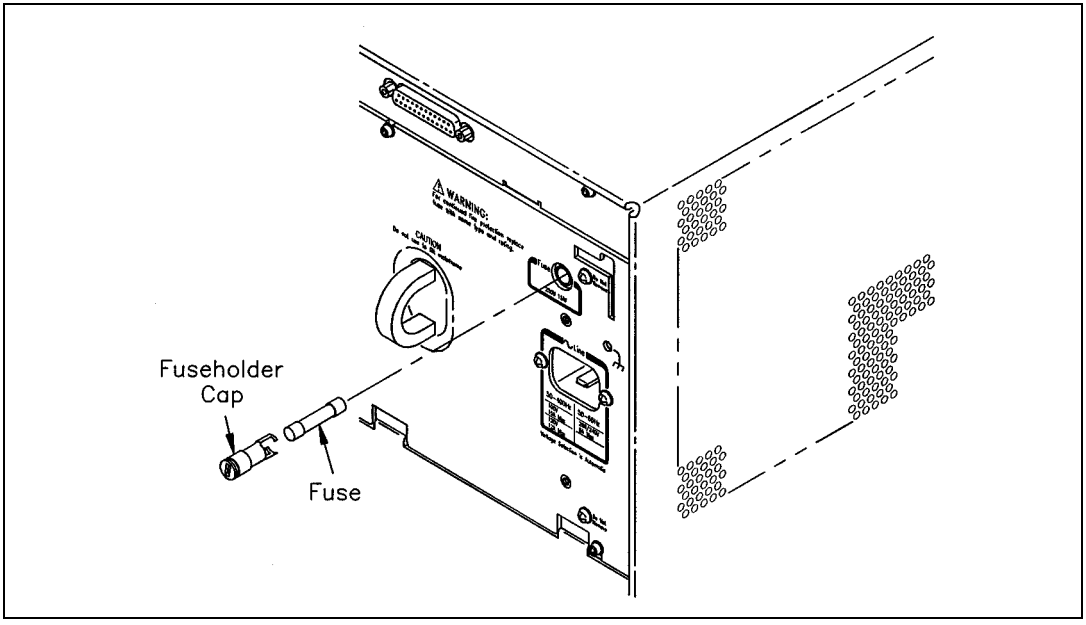


Figure 1-5. Replacing the Power Line Fuse

Warning For continued protection against fire hazard, replace fuse only with fuse of same type and current rating.

Power Cords

Table 1-2 shows the power cord rating requirements.

Table 1-2. Rating Requirements for Power Cords

Country	Volts	Rated Amps
U.K.	250 VAC	10 A
Australia	250 VAC	10 A
Europe	250 VAC	10 A
U.S./Canada*	125 VAC	13 A
Switzerland	250 VAC	10 A
Denmark	250 VAC	10 A
Japan	125 VAC	15 A
* CSA Certification includes only this power cord.		

Note AC mains power supply cords used with the VXI-1501 must meet the requirements of ANSI/UL817 for use in the United States, CSA C22.2 21 and 49 for use in Canada, and IEC 227 or 245 for use in the European Union. AC mains power supply cords used with the VXI-1501 in other countries must be approved by the authority having jurisdiction in that country. Power cords with high power ratings are available from National Instruments. Make certain that any replacement cord can handle the indicated loads.

Warning For protection from electric shock hazard, power cord ground must not be defeated. The front power switch on this instrument does not disconnect all power from internal circuits. In case of emergency, the operator may need to disconnect the power to this mainframe. Do not block the operator's access to the power cord, or (if installed in a rack) to the circuit breaker that supplies power to the mainframe.

If a remote standby switch is connected to the mainframe by way of the rear panel 25-pin Sub-D connector, the operator may not be able to turn off this unit by using the front panel switch. Notify the operator of the location of the disconnect device (either the power cord or a circuit breaker) for this mainframe.

Safety Grounding Information

Warning For protection from electrical shock when operating at mains frequencies greater than 66 Hz, connect the chassis ground terminal to permanent earth ground.

Grounding Procedure

Connect a 16 AWG (1.3 mm or larger) wire to the PEM nut shown in Figure 1-6. The wire must be green with a yellow stripe or bare (no insulation). Use an M4 × 10 screw, grounding lug, and toothed washers (or toothed lug) as shown in Figure 1-7. Securely attach the other end of the wire to a permanent earth ground using toothed washers or a toothed lug.

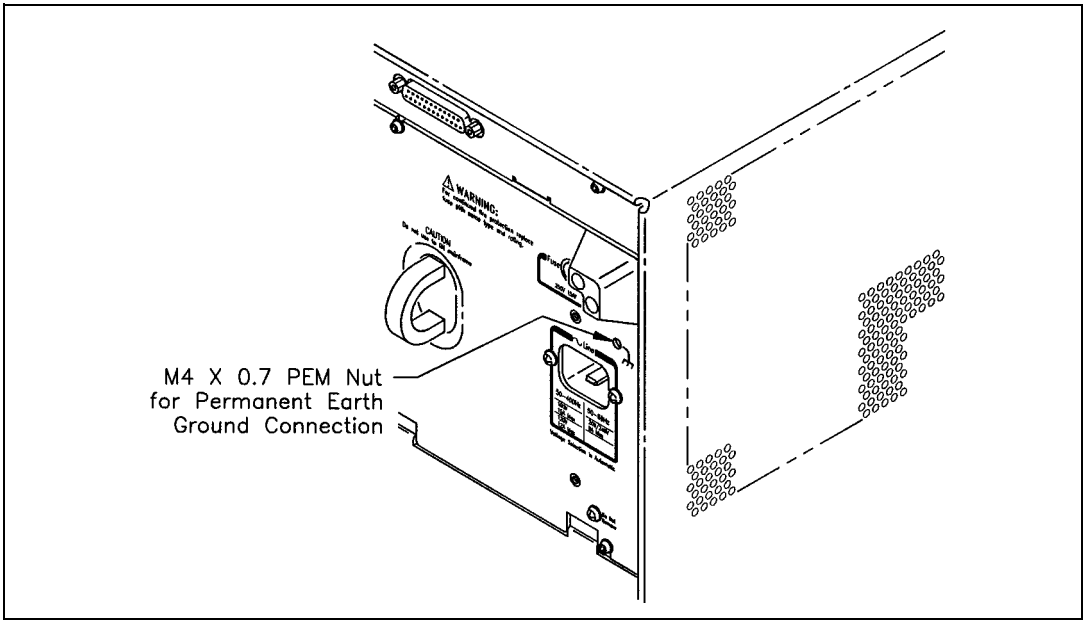


Figure 1-6. Grounding Connection

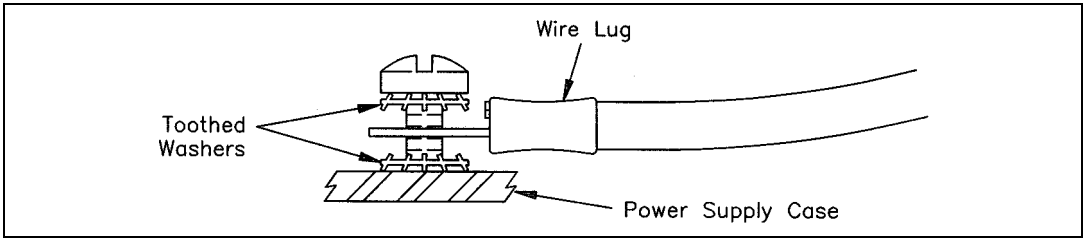


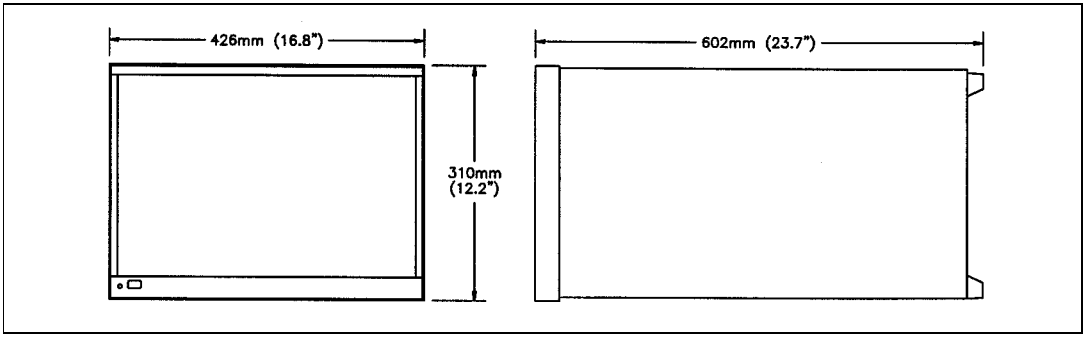
Figure 1-7. Grounding Screw, Toothed Washers

A

VXI-1501 Specifications

The VXI-1501 mainframes are 100% compatible with VXIbus specification revision 2.0.

Overall Mainframe Size



Mainframe weight ..... 22 Kg (48. 5 lbs) with no modules installed

Module size ..... 13 C-Size slots
Mainframes also accept A-Size or B-Size modules with the appropriate adapters

Input power

50–60 Hz input power ..... Automatic voltage ranging
Nominal range ..... 100–240 VAC ±10%
Nominal frequency range ..... 50–60 Hz ±10%

400 Hz input power

Nominal voltage range..... 100–120 VAC ±10%
Nominal frequency ..... 400 Hz ±10%

DC input power

Input voltage range ..... 100 VDC min; 370 VDC max

General power supply.....Power factor corrected

Power switch .....On/Standby with lighted indicator in front
Rear panel connection allows remote operation

Inrush current.....40 A max
Designed to meet EN-60555-2

Socket for detachable line cord .....IEC 320 “HOT”

Chassis ground tap on rear panel.....M4 × 0.7 threaded insert

Fuse

Voltage	Maximum Current	Fuse
100 VAC	15 A	15 AF
120 VAC	12 A	15 AF
220–240 VAC	8 A	15 AF

Power Supply Outputs

DC Output Voltage	Peak DC Output Current (IMP*)		P–P Dynamic Current (IMD**)	Current Limit (supply shuts down)
	40 °C	55 °C		
+5 V	65 A	60 A	9.0 A	70–80 A
+12 V	14 A	12 A	2.5 A	14–18 A
–12 V	14 A	12 A	2.5 A	14–18 A
+24 V	14 A	12 A	5.0 A	15–19 A
–24 V	12 A	10 A	5.0 A	12–16 A
–5.2 V	65 A	60 A	8.5 A	70–80 A
–2 V	35 A	30 A	4.5 A	35–41 A

* IMP = Rated mainframe peak DC output current as defined by the VXIbus Specification.
** IMD = Rated mainframe peak-to-peak dynamic current as defined in the VXIbus Specification by a current vs. frequency curve.

VXI Ripple/Noise[1]

DC Output Voltage	Allowed Variation	Max. DC Load Ripple/Noise	Max. Induced Ripple/Noise
+5 V	+0.25/–0.125	50 mV	50 mV
+12 V	+0.06/–0.36	50 mV	50 mV
–12 V	–0.60/+0.36	50 mV	50 mV
+24 V	+1.2/–0.72	150 mV	150 mV
–24 V	–1.2/+0.72	150 mV	150 mV
–5.2 V	–0.26/+0.156	50 mV	50 mV
–2 V	–0.10/+0.10	50 mV	50 mV

Maximum Power Output
Uncertainty in shutdown is due to variable loading. Heavy loading on +5 V, –2 V, and –5.2 V will cause shutdown at the lower edge of the band. Heavy loading of the +12 V, –12 V, +24 V, or –24 V will cause shutdown at the higher edge of the band. Low line voltage (90 VAC) will cause shutdown at the lower edge of the band.

Humidity ..... 10-90% RH noncondensing

Temperature range

Nonoperating ..... –20 °C to +70 °C
Operating ..... 0 °C to 50 °C

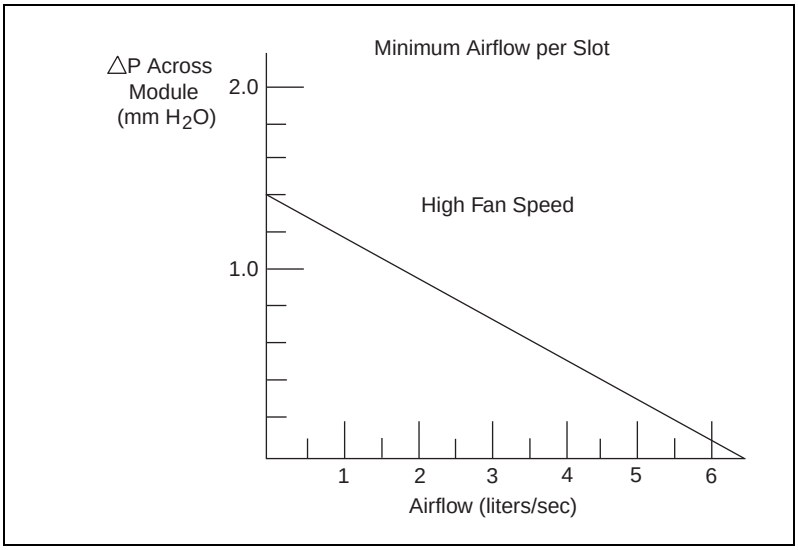
Shock ..... 30 g, 11 ms, half sine
3 shocks per face

Random vibration

Nonoperating ..... 5-500 Hz, 2.46 g_{rms}
Operating ..... 5-500 Hz, 0.31 g_{rms}

[1] Per VXI Specification rev. 1.4.

Cooling Provided



Fan set to “Variable” .....Quiet operation (approximately 75% airflow) at <30 °C ambient temperature and high speed operation at >40 °C ambient temperature

Fan set to “High” .....Full airflow all the time

For modules with typical density ....10 °C rise at 60 W per slot
15 °C rise at 75 W per slot

Acoustical noise

Low fan speed.....48 dBA sound pressure at bystander position. Lpa = 48 dB fiktiver Arbeitsplatz, normalier Betrieb, nach DIN 45635 T. 1

High fan speed.....56 dBA sound pressure at bystander position. Lpa = 56 dB fiktiver Arbeitsplatz, normalier Betrieb, nach DIN 45635 T. 1

Safety .....Meets UL 3111-1, CAN/CSA C22.2 #1010.1, IEC 61010-1, and EN 61010-1

B

Technical Support Resources

This appendix describes the comprehensive resources available to you in the Technical Support section of the National Instruments Web site and provides technical support telephone numbers for you to use if you have trouble connecting to our Web site or if you do not have internet access.

NI Web Support

To provide you with immediate answers and solutions 24 hours a day, 365 days a year, National Instruments maintains extensive online technical support resources. They are available to you at no cost, are updated daily, and can be found in the Technical Support section of our Web site at `www.ni.com/support`

Online Problem-Solving and Diagnostic Resources

- **KnowledgeBase**—A searchable database containing thousands of frequently asked questions (FAQs) and their corresponding answers or solutions, including special sections devoted to our newest products. The database is updated daily in response to new customer experiences and feedback.
- **Troubleshooting Wizards**—Step-by-step guides lead you through common problems and answer questions about our entire product line. Wizards include screen shots that illustrate the steps being described and provide detailed information ranging from simple getting started instructions to advanced topics.
- **Product Manuals**—A comprehensive, searchable library of the latest editions of National Instruments hardware and software product manuals.
- **Hardware Reference Database**—A searchable database containing brief hardware descriptions, mechanical drawings, and helpful images of jumper settings and connector pinouts.
- **Application Notes**—A library with more than 100 short papers addressing specific topics such as creating and calling DLLs, developing your own instrument driver software, and porting applications between platforms and operating systems.

Software-Related Resources

- **Instrument Driver Network**—A library with hundreds of instrument drivers for control of standalone instruments via GPIB, VXI, or serial interfaces. You also can submit a request for a particular instrument driver if it does not already appear in the library.
- **Example Programs Database**—A database with numerous, non-shipping example programs for National Instruments programming environments. You can use them to complement the example programs that are already included with National Instruments products.
- **Software Library**—A library with updates and patches to application software, links to the latest versions of driver software for National Instruments hardware products, and utility routines.

Worldwide Support

National Instruments has offices located around the globe. Many branch offices maintain a Web site to provide information on local services. You can access these Web sites from `www.ni.com/worldwide`

If you have trouble connecting to our Web site, please contact your local National Instruments office or the source from which you purchased your National Instruments product(s) to obtain support.

For telephone support in the United States, dial 512 795 8248. For telephone support outside the United States, contact your local branch office:

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China 0755 3904939, Denmark 45 76 26 00, Finland 09 725 725 11,
France 01 48 14 24 24, Germany 089 741 31 30, Greece 30 1 42 96 427,
Hong Kong 2645 3186, India 91805275406, Israel 03 6120092,
Italy 02 413091, Japan 03 5472 2970, Korea 02 596 7456,
Mexico (D.F.) 5 280 7625, Mexico (Monterrey) 8 357 7695,
Netherlands 0348 433466, New Zealand 09 914 0488,
Norway 32 27 73 00, Poland 0 22 528 94 06, Portugal 351 1 726 9011,
Singapore 2265886, Spain 91 640 0085, Sweden 08 587 895 00,
Switzerland 056 200 51 51, Taiwan 02 2528 7227,
United Kingdom 01635 523545

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